Introduction: Invertebrate species conservation in Victoria

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This dedicated issue of *The Victorian Naturalist* is about invertebrates, that massive variety of animal life so important in sustaining ecosystems, yet disregarded by most people, to whom the need for their conservation and very existence is not apparent. Without invertebrate participation in processes such as pollination, decomposition and recycling, as predominant members of food webs, and as controllers of pests in crop and commodity protection, the world would differ greatly from that which we see and use, and human interests would be compromised severely. An earlier special issue of this journal (Yen and New 1995) gave a broad perspective of invertebrate conservation needs in Victoria, and this issue examines more recent progress with greater focus on individual species and their needs. Some of these species have been studied for many years, and summaries of their conservation programs are given; others are more novel and indicate the continuing need and expansion of interests in invertebrate conservation in the state.

Invertebrates were amongst the earliest nominated candidates for scheduling as threatened species under the *Flora and Fauna Guarantee Act* 1988 (FFG), and the ecologically diverse trio of the Giant Gippsland Earthworm, the Hemiphlebia Damselfly and the Eltham Copper Butterfly were an important collective flagship in demonstrating the great variety of invertebrate ecology to people to whom such animals were strangers, and to whom their conservation and wider evolutionary importance were novel (Yen *et al.* 1990). Since then, a considerable variety of insects, snails, freshwater crayfish and others have been added to the FFG schedules, so that (at 20 July 2006) 71 invertebrates are listed for attention in the state. This special issue presents short accounts of some of these species (mainly those which have inspired the pioneering and establishment of the discipline of invertebrate conservation in Victoria), to demonstrate recent increases in knowledge and management related to their conservation needs. The species listed so far are but a tiny fraction of possible deserving candidates. Some of the species discussed below are not yet listed for formal conservation significance, and exemplify the variety of possible future requirements. Unlike the major vertebrate groups, for which FFG schedules of threatened species are relatively complete, the listed invertebrates are simply those for which some case of need has been made and adjudged valid. Numerous vast groups of insects and others are not represented by listed species. This does not reflect lack of equivalent need but simply lack of capability to evaluate their conservation status, and lack of specialists versed in the biology of those creatures. The inevitable wider consequence is that invertebrate conservation has been progressed mainly by attention of members to a few 'well-known' groups, amongst which butterflies are paramount, and (more rarely) through the zeal of individual proponents for members of less familiar groups.

Elsewhere in the world, two other contrasting perspectives on how best to pursue invertebrate conservation occur. First, in parts of the northern temperate zone, predominantly in the United Kingdom and parts of western continental Europe, taxonomic, biological and distributional knowledge of many invertebrate groups is sufficient for finely honed species-focused conservation programs based on very detailed knowledge as a foundation for effective management and recovery (Stewart and New 2007). Programs on the British butterflies, for example, draw on well over a century of collector interest and detailed historical records of incidence and abun-

dance, which allow trends in distribution and abundance to be found and interpreted (see Asher *et al.* 2001).

Second, the vast diversity of invertebrates over much of the tropics renders any such equivalent focus on individual species very difficult, because of poor taxonomy (with most species undescribed), poor ecological understanding and, as importantly, the lack of resident expertise and potential support for conservation in relation to the needs of burgeoning human populations (Lewis and Basset 2007). Australia manifests an intermediate position: our butterflies, and some other insects, are indeed reasonably well-known through hobbyist interests, but most other invertebrate groups remain more intangible as the province of very limited interest by few people. Whereas the need for conservation of many a fly, snail or worm may be real, the transfer of 'a name on a list' to a practical and successful management program for such species is an enormous step, particularly when based on very limited knowledge. However, and as emphasised in a major overview of non-marine invertebrate conservation needs in Australia (Yen and Butcher 1997), the vast diversity of invertebrates ensures that only a tiny proportion of species can ever be considered individually. For most, the only practical avenue to their security is to protect the habitats they frequent.

We have deliberately limited this issue to representative terrestrial and freshwater invertebrates in Victoria, simply because many of these are better known than many of their marine counterparts, and not in any way to diminish the importance of marine invertebrates or the need to conserve them. Animals such as butterflies, dragonflies, and some moths and beetles, are far better known, so that their conservation needs and priorities can be assessed more realistically, on a scale of 'secure' to 'critically endangered' to reflect urgency of the attention needed. Allocating invertebrates convincingly to a particular category of threat is a complex task, but necessary as a means to give priority to the most needy species in a work climate in which support is inadequate for all needs to be met. Only for butterflies has a national Action Plan been formulated (Sands and New 2002) to appraise the needs and priorities for a whole invertebrate group in Australia. Similar exercises would be feasible for dragonflies and damselflies, and a few select groups of other invertebrates, but the conclusions by Butcher and Doeg (1995) that 'Current information on aquatic invertebrates in Victoria is insufficient for most approaches to conservation' and 'While a few species of conservation significance have been identified, concentration on the single-species approach will leave many others open to further decline' are equally true for most terrestrial taxa.

The act of listing a species under FFG, or equivalent legislation elsewhere, implies concern for its future usually because of evident decline in abundance or distribution, including loss from sites changed by human activities, and commonly accompanied by definition of the 'threats' causing such concerns. It is relevant to emphasise here that simple 'rarity' is not alone evidence for conservation need. Vast numbers of invertebrate species are indeed 'rare', in some combination of occurring in low numbers, or in very limited areas, and in being ecologically specialised. However, many such species are not 'threatened', and may continue to thrive unless conditions change. Many are known from only single sites, or very few such places, but may need only a hectare or less of suitable habitat in order to persist – small habitat areas that could not support an effective population of larger animals such as most vertebrates. Such sites may indeed merit monitoring to detect any threats that arise, but it is usually not feasible (other than by improved buffering of important habitat to prevent loss and degradation) to plan to protect them from chance events such as wildfire or flooding. The more focused basis for conservation concern is 'threat', not least because detection and definition of threat(s) dictates a path to constructive management through threat removal and ameliorative measures to conserve the population or species affected. Site (broadly, physical habitat) security is the foundation of this; without a 'place to live' a species or population is doomed. Simply safeguarding a site does not guarantee conservation, however, and continuing management is commonly needed to sustain the

resources and conditions needed by any particular species. This paragraph exemplifies the twin conservation paradigms distinguished by Caughley (1994), namely (1) the 'small population paradigm' for which conservation concerns arise simply from the population being small, and so subject to adverse genetic effects such as inbreeding and the possible effects of habitat limitation, so that the population could be extirpated by a single catastrophe, and (2) the 'declining population paradigm' for which the causes of decline (i.e. threats) define parameters for management.

Invertebrate conservation concerns in Victoria exemplify both these schools of thought. A number of species have been listed under FFG simply because they are rare, some of them narrow range endemics, but with little specific evidence of threat. The number of discrete populations is one of the criteria incorporated into the World Conservation Union's categories of threat. Other species are truly threatened, predominantly through loss of (or major changes to) their habitats and critical resources. The initial act of listing such poorly-understood species under FFG ideally leads to accumulation of knowledge that, in turn, reveals either (1) that management for greater ecological understanding, threat amelioration and recovery is needed, and definition of the specific components of a convincing management plan, or (2) that the initial concerns were misplaced and that the species is more abundant, widespread and/or secure than earlier supposed. The latter, as well as successful management leading to demonstrated recovery, may be grounds for delisting the species, not least to refocus support for more deserving taxa on the list. Two other grounds for delisting a taxon, both rare but noted here for completeness, are (1) if the species is known to have become extinct, for example through monitoring of the last or only known population, and (2) if taxonomic changes reveal it not to be a distinctive entity, but synonymous with a non-threatened taxon. However, isolated or other 'significant' populations may still be eligible for conservation attention.

In this issue of *The Victorian Naturalist*, authors have been invited to review and comment on the status of and progress to understanding conservation needs for a variety of Victoria's threatened (or presumed threatened) invertebrates. A further paper exemplifies how a Victorian institution is supporting wider invertebrate conservation within Australia through a captive breeding programme of the Lord Howe Island Stick Insect – the only non-Victorian species included, but one to whose well-being State expertise is contributing significantly. These cases include some species that have attracted attention over the last 20 years. Collectively these accounts demonstrate changing attitudes to invertebrates in Australia, and the ways in which objective scientific evidence is playing important roles in formulating conservation protocols. The consequences of FFG listing, noted by Clunie and Reed (1995) include (1) protection from take, an action with very mixed benefits for conservation (Greenslade 1999); (2) construction of an Action Statement, to elaborate on what is known and what needs to be known to ensure long-term survival in the wild ; (3) moves to protect habitat and critical resources from further despoliation and loss; (4) becoming foci for funding, commonly with additional support by formation of community groups; (5) elevated public profile through a variety of advisory and media exposure; and (6) obligations to consider the species in planning decisions for land or water management. In these steps, some of the invertebrates listed for conservation protection under FFG have become some of the best-known non-pest invertebrates in the State. For others, no such plan is currently possible. The above 'consequences' are all evident in the examples we summarise here. Collectively they help to advance wider knowledge of the conservation needs of these intriguing animals.

Many uncertainties and challenges remain. The over-arching effects of future climate change have as yet been scarcely defined, for example, but may markedly influence the vulnerability of many invertebrate species (including a variety of alpine region endemics) that already survive in only small areas of marginally suitable habitat that may be changed dramatically within a few decades.

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Female Golden Sun-moth *Synemon plana*. Photograph supplied by Lucy Gibson.